

# Will the Impact of the 2009 Drought Be Different from 2002?

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Groundwater, which has emerged as India's prime adaptive mechanism in times of drought, will play a crucial role this year since the aquifers were recharged in 2006-08. The impact of the drought of 2009 will therefore be less severe than the drought of 2002. Beyond the immediate response, we need to think long term. Instead of pumping money into dams and canals, Indian agriculture will be better off investing in "groundwater banking". This involves storing surplus flood waters in aquifers which can be drawn upon in times of need.

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Assuming that the overall rainfall deficit this year will hover around 20%, will the impacts of the 2009 drought on Indian agriculture be different from the 2002 and earlier droughts in their scale and severity? We think yes; this year's drought will have significantly less impact on food production and the livelihoods of the poor. We explain why things may not turn out to be as bad as the doomsday stories suggest.

Hydrologists categorise droughts into four types depending upon the severity of their socio-ecological impact. Mere lack of precipitation during a period is considered a *meteorological drought*, which if long-lasting enough turns into an *agricultural drought* as crops begin to suffer moisture stress. All available water in nearby storages is marshalled to save dying crops. When water storages themselves dry up for the lack of replenishment, a *hydrological drought* ensues, causing decline in food and fodder production. A succession of hydrological droughts can create havoc, leave a region's economy sapped and cause misery all around. This phase is sometimes referred to as *socio-economic drought* (IWMI 2005). In recent times, Afghanistan

suffered such a socio-economic drought during 1998-2002; Baluchistan and Sindh during 1997-2002 (ibid).

For millennia until the 1960s, a prolonged meteorological drought readily turned into a hydrological or even a socio-economic drought in India resulting in famines and mass starvation deaths. A drought meant an entire crop year lost. The main kharif crop would of course be lost. Empty tanks and reservoirs would also mean loss of rabi and summer crops. During recent decades, however, Indian agriculture has responded to droughts differently from the way it used to respond before, thanks to the spread of groundwater irrigation.

## Production versus Stabilisation

Compared to tanks and surface reservoirs, groundwater storage plays a much larger "stabilisation" role as distinct from the "production" role of irrigation in agriculture. When managed well, groundwater storage lasts long after all surface storages dry up during a drought. This is why, in the history of Indian agriculture, well-digging activity always peaked during droughts (Shah 2009). Rapid groundwater development has many cons; but it has pros as well. One of these is drought proofing, especially after a series of good monsoons.

This has been evident in the recent Indian experience. In 1965-66, when rainfall was 20% below normal, India suffered a 19% decline in foodgrain production

over the previous year; but then, the groundwater revolution was just beginning. In 1987-88, in the middle phase of the groundwater boom, rainfall once again was 17.5% below normal; but this time, the foodgrain production was down by just over 2%. Groundwater irrigation played a big role in explaining this change from the mid-1960s (Gandhi and Namboodiri 2007).

But then we never paid much attention to managing groundwater. Reckless expansion in groundwater irrigation without concomitant effort to replenish the resource left many aquifers depleted. In 2002-03, India received 22% less than normal rainfall. To add to this, the rainfall was 8% less than normal in 2000-01 and 6% lower in 2001-02. Surface reservoirs were all but empty; and depleted groundwater storages had little chance to recover. Conditions were ripe for a meteorological drought to turn into a hydrological drought. Little surprise, then, that in the 2002-03 drought, farm output fell significantly as in 1966. The value of paddy output declined by 22%; oilseeds by 23.5% and wheat by 9.5%.

None of the conditions that made 2002-03 a serious drought are present today. The years 2005-06, 2006-07 and 2007-08 were all above normal monsoon years, when depleted aquifers had time and rainfall to recover. As a result, even if 2009 ends up a meteorological drought, it is unlikely to turn into a hydrological drought as bad as in 2002 for the country as a whole. Rainfed paddy will be hit hard; but wheat and other crops will suffer less, especially if increased energy for groundwater irrigation is made available.

Groundwater has emerged as India's prime adaptive mechanism in times of drought. Therefore, we need to better understand and master the "stabilisation" role of groundwater. During a drought, groundwater aquifers are doubly hit: there is less rainfall and little recharge to aquifers but there is also additional demand pressure on the resource as farmers struggle to save their crops and livelihoods. During a good monsoon, the same factors work in opposite direction. Demand for groundwater is less and natural recharge is more.

A pecking order has now emerged in India with respect to drought-proneness of different areas. Rainfed agriculture areas are hit the hardest by a drought. These are followed by areas dependent on tank irrigation. Only well owners have some protection in tank commands, these can provide a life-saving irrigation. Canal commands under run-of-the river systems are better protected than tank commands because of better-recharged aquifers, but command areas of reservoir-based irrigation systems are even better off as some of the reservoir storage would last even when rivers dry up.

Dugwell irrigated areas dependent on natural recharge are greatly at risk, but those in canal commands are less affected by drought due to continuous aquifer recharge. By far the best protected areas are those irrigated by deep tubewells, especially in canal-recharged areas like upper Punjab and central Gujarat. Equally well protected are regions like Saurashtra in Gujarat where dug well irrigation is now supported by hundreds of thousands of check dams and percolation tanks



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constructed by communities with government support over the past two decades (Shah 2009). These are least affected by a single drought; but even deep tubewells may dry up in a succession of drought years.

Hard rock areas of peninsular region – 65% of India's landmass – are far more dependent on tanks and dug wells which become useless during a drought in the absence of aggressive groundwater recharge in preceding years of good monsoon. Little surprise then that the 2002-03 drought hit the southern states much harder than the tubewell irrigated states of the Indo-Gangetic basin.

### Managing Groundwater

In the current as well as future droughts, those states will emerge unscathed that have learnt to master and manage the “stabilising” role of groundwater. Gujarat is the classic example. It has a rainfall deficit in roughly half of its farming areas, especially north Gujarat. The Gujarat government has been making doomsday predictions of a significant decline in farm production. Our prediction, however, is that Gujarat will actually increase its farm output this year.

The state has wisely invested in community-based groundwater recharge. It has had four good monsoons in a row, giving its aquifers opportunity to recover. Now, it has begun providing farmers 18-20 hours of power per day instead of the normal eight hours (*Times of India*, 19 August 2009). This may increase its farm power subsidy bill by some Rs 2,000 crore this year; but this may be worthwhile if it helps Gujarat farmers to produce Rs 50-55,000 crore worth of farm and dairy output. With these policies, the state may not only maintain but even surpass its 9.6% growth rate in agricultural GDP.

In Rajasthan, one of India's most drought-prone states, people talk of four kinds of droughts: *Annakal* (shortage of food), *Jalakal* (lack of drinking water), *Trinakal* (shortage of fodder), and *Trikal* (shortage of all three) (Dalbir Singh n.d.). In the past, saving the cattle from starving was as much a priority as saving the family members from starvation deaths. Today, however, livestock and dairying have emerged as a powerful bulwark

against drought in states like Gujarat and Andhra Pradesh.

In many parts of India today, dairy production booms during a drought. During the 2002 drought, the value of paddy and oilseeds output fell over 20% and of wheat, nearly 10%; but the value of livestock and milk production grew nearly 3% on an all-India basis. Thanks to the livestock economy, India's value of output from agriculture and allied sectors fell only 6.3% in 2002-03. In states like Andhra Pradesh, the value of milk production – which is already approaching the value of crop production – increased by 12%; and in Gujarat by 3.6%.

Dairying has emerged as the farmer's adaptive strategy during droughts. As crops fail, farmers divert land, water and other resources to produce more feed and fodder to preserve their livelihoods and income. And milch cattle respond strongly, and immediately, to better feeding by readily yielding more milk.

But dairying works as a drought-buffer only where there exists a strong network of dairy cooperatives. These help convert increased milk production into what Amartya Sen called “exchange entitlements”. We expect milk production to be sustained at 2008 levels or even increase this year in Gujarat, Rajasthan, Andhra Pradesh, Karnataka and Tamil Nadu; this will partially compensate for the decline in crop output. Eastern India does not have strong milk marketing institutions. As a result, dairying plays no drought-buffer role here. The smallholder in Bihar or Orissa cannot rely on milk to tide over a drought quite like small farmers can in Gujarat, Andhra Pradesh, Rajasthan or Tamil Nadu.

### ‘Groundwater Banking’

While the 2009 drought will have to be dealt with in a crisis mode, there is renewed demand for more large-scale irrigation projects and inter-linking of rivers as a long term response. However, by themselves, dams and canals have proved increasingly useless during droughts. Run-of-the-river irrigation systems have natural limitations during droughts. And few Indian dams have carry-over storage that is available to drought-proof agriculture. Moreover, the use of dam storage is driven more by the demands of power generation

than by the needs of the farmers. The only storage that can provide some measure of drought proofing is groundwater storage. Instead of pumping money on dams and canals, Indian agriculture will be better off investing in “groundwater banking”. This involves storing surplus flood waters in aquifers which can be drawn upon in times of need.

India needs to reinvent canal irrigation as a means to “bank” groundwater in times of surplus surface water availability. Instead, command areas of many existing irrigation projects are shrinking because of a variety of reasons (Shah 2009). Many tertiary canals are in disrepair. When water does not reach tail ends, farmers flatten canals and bring the land under plough. Also, as farmers turn to groundwater, they lose interest in canals and their maintenance. According to government data, despite massive investments in the so-called Accelerated Irrigation Benefits Programme, India's canal irrigation is in fact decelerating and has lost 3 million ha of canal irrigated areas since 1991 (SANDRP 2006). This trend does not augur well for insulating the country from drought. The best thing we can do with our surface storages is to maximise their use for groundwater banking by spreading the water over as large an area as possible.

For the Indian water establishment, however, the idea of using surface water resources for groundwater recharge is blasphemy. But this is a common practice in arid and semi-arid regions like the western United States (US) and Australia. In the western US, groundwater banking is done in two ways: first, by direct aquifer recharge with surplus surface water; and second, by providing farmers imported surface water in lieu of groundwater pumping (<http://www.docstoc.com/docs/3875990/The-Basics-of-a-Groundwater-Banking-Study-An-Introduction-of>).

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Both these increase groundwater storage which evaporates far less than surface water. Stored groundwater is pumped to save crops during dry periods and replenished at the first opportunity. Such groundwater banking can insulate India from droughts.

Groundwater banking is an idea whose time has come in India. We need to adapt the concept to fit our reality. India may not have vast unpeopled sandy-alluvial tracts that can serve as recharge basins; nor can we effectively use surplus surface water in lieu of groundwater pumping, given our vast number of irrigators and the absence of enforceable property rights. But we can certainly evolve recharge technologies suited to our conditions. Groundwater banking can be done in a decentralised format as well; Saurashtra is a living example; and the National Rural Employment Guarantee Scheme (NREGS) is an ideal vehicle for doing this country-wide.

If the monsoon fails to revive, 2009 will be the year of the NREGS. Many states have not been able to use the resources available under this ambitious scheme to provide employment guarantee to rural poor. In a drought, however, demand for work will increase manifold. And the best works to undertake would be structures to support groundwater banking. The NREGS can provide employment to the needy as well as prepare the ground for dealing with future droughts. If every village were to construct five new water harvesting and recharge structures, and desilt existing ones, it will be better prepared to survive the next drought when it comes.

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